2023 Trial Reports

UOA2105-013RTX – Development and extension to close the economic yield gap and maximise farming system benefits from grain legume production in South Australia.

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

THE UNIVERSITY of ADELAIDE

Government of South Australia
Department of Primary Industries and Regions

SARDI SOUTH AUSTRALIAN RESEARCH AND DEVELOPMENT INSTITUTE

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Project Investment

Grains Research and Development Corporation: project UOA2105-013RTX Development and extension to close the economic yield gap and maximise farming systems benefits from grain legume production in South Australia

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Cover image: Sunset over a lentil crop, north of Brinkworth, 2023. Photo credit: Sarah Day

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HART/CONDOWIE – HUB SITE

SITE SUMMARY

Condowie received adequate rainfall early in the growing season, with above average rainfall in April and June 2023 (Figure 1). However, well below average rainfall was received in July, September, October, and November, limiting moisture availability for plants during reproductive growth stages.

The Condowie site experienced 11 frost events (<0°C) from May through until October (Figure 2), with the coldest night occurring in late October, dropping to -3.5°C overnight.

The Condowie field trial site was situated on a brown to grey clay loam soil (Table 1). The soil was strongly alkaline with low levels of nitrogen and phosphorus. The soil had low levels of salinity in the top layers, with increasing salinity at depth.

The average grain yields for the site were 1.24 t/ha for chickpea and 1.93 t/ha for lentil.

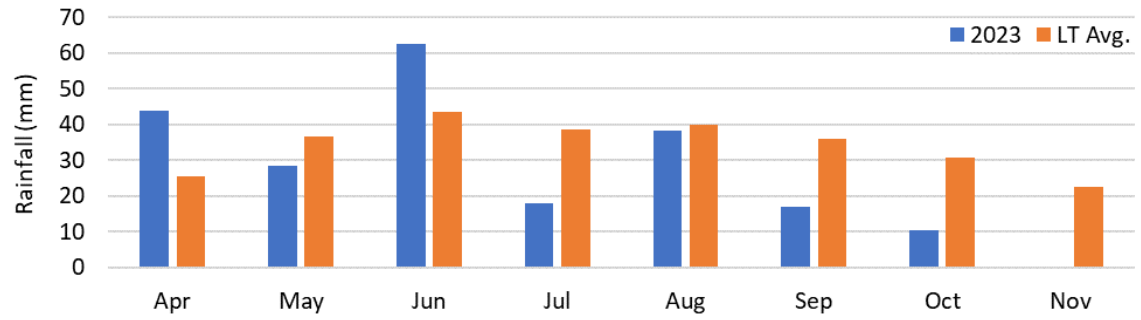

Figure 1. Monthly rainfall recorded at the Condowie field trial site in 2023 compared to the long-term average rainfall from the Snowtown (Condowie) BOM weather station (#21015).

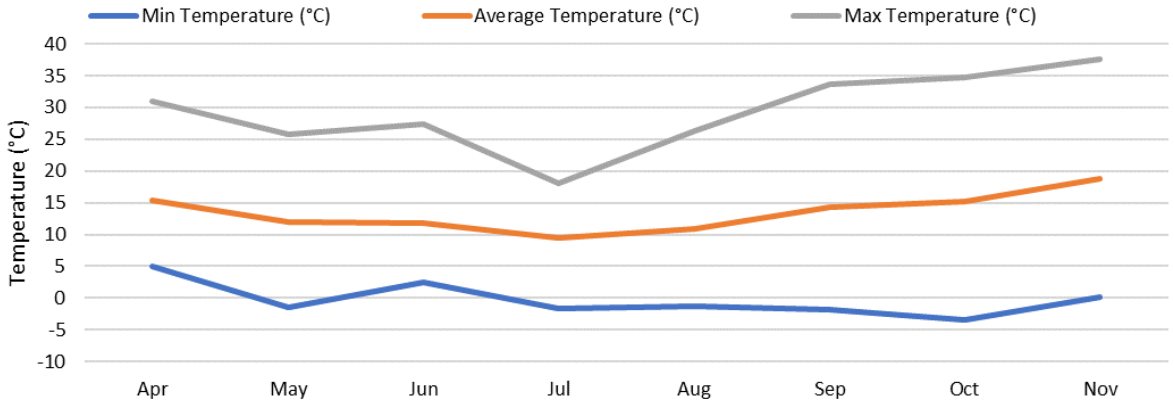

Figure 2. Minimum, average and maximum temperature (°C) recorded during the growing season at the Condowie field trial site in 2023.

Table 1. Condowie soil profile characterisation (brown to grey loam/clay), 2023.

Depth	NH_3-N	NO_3-N	P	K	S	OC	EC	pH	pH
(cm)			(mg/kg)			(%)	(dS/m)	($CaCl_2$)	(H_20)
0-10	1	8	17	375	18.0	0.64	0.322	7.6	8.7
10-30	1	5	3	215	6.1	0.49	0.239	8.0	9.2
30-60	1	3	3	193	35.6	0.31	0.393	7.9	9.6
60-90	<1	2	2	245	71.9	0.19	0.720	8.1	9.7
90-120	1	2	<2	277	134.1	0.20	0.905	8.2	9.7

Depth	Cu	Fe	Mn	Zn	B	Exc Ca	Exc Mg	Exc K	Exc Na	Exc Al

(cm)			(mg/kg)				(meq/100g)			
0-10	0.90	8.80	3.30	0.32	4.36	13.17	4.30	0.95	1.86	0.035
10-30	0.92	5.50	0.71	0.15	4.97	15.05	5.37	0.65	2.03	0.034
30-60	1.06	5.60	0.67	0.17	7.18	11.97	5.94	0.53	3.36	0.027
60-90	0.92	5.40	0.70	0.11	13.87	8.87	6.48	0.64	5.88	0.031
90-120	0.63	5.90	0.68	0.11	21.54	7.94	6.38	0.74	7.09	0.035

Table 2. Hart Field Trial Site soil characterisation, 2021.

Depth	NH_3-N	NO_3-N	P	K	S	OC	EC	pH	pH
(cm)			(mg/kg)			(%)	(dS/m)	($CaCl_2$)	(H_20)
0-15	1	11	10	304	5.2	0.97	0.177	7.0	8.2
15-35	1	9	16	229	6.2	0.68	0.197	7.0	8.3
35-55	1	11	23	306	4.8	0.71	0.257	7.4	8.7
55-75	1	5	11	260	34.5	0.37	0.510	7.4	9.4
75-105	1	4	20	308	70.2	0.40	0.675	7.9	9.4

Depth	Cu	Fe	Mn	Zn	B	Exc Ca	Exc Mg	Exc K	Exc Na	Exc Al
(cm)			(mg/kg)					(meq/100g)		
0-15	1.19	11.8	3.48	1.20	2.76	23.21	3.65	0.98	0.50	0.08
15-35	1.27	12.3	3.16	0.30	2.22	19.97	4.59	0.68	0.78	0.08
35-55	1.24	11.2	3.85	0.83	3.37	17.25	5.27	0.79	1.60	0.05
55-75	1.25	9.6	2.21	0.47	8.48	11.88	6.20	0.67	4.32	0.04
75-105	0.95	7.8	2.09	0.41	16.04	10.72	6.08	0.78	5.34	0.06

LENTIL DISEASE MANAGEMENT

Authors: *Sarah Day, Sara Blake*

Aim: This trial aims to assess (1) yield loss from disease infection in lentil, (2) economics of disease control strategies

Treatments: See Table 3 and Table 4.

All seed was treated with EverShield Seed Treatment to protect seedlings from early disease infection.

Each treatment consisted of 3 key fungicide application stages; prior to canopy closure, post-canopy closure but prior to podding applied ahead of rain, and at early podding.

All fungicides were applied ahead of a rain event where > 5 mm was forecast.

Table 3. Lentil varieties and associated disease resistance ratings. Source: 2023 South Australian Crop Sowing Guide

Variety	Botrytis Grey Mould	Ascochyta Blight (Foliar)	
		Pathotype 1 (Nipper virulent)	Pathotype 2 (PBA Hurricane XT virulent)
PBA Bolt	S	MR	MRMS
PBA Highland XT	MS	MR	MR
PBA Jumbo2	MR (P)	R	RMR (P)

Key: S = susceptible, MS = moderately susceptible, MRMS = moderately resistant/moderately susceptible, MR = moderately resistant, R = resistant, (P) = provisional rating and subject to change when additional data becomes available.

Table 4. Five fungicide treatments applied to lentil at Hart, 2023.

Treatment	Details	Date applied

T1	Untreated control	
T2	Procymidone prior to canopy closure f/b Carbendazim post-canopy closure	23 August 2023 Not Applied^
T3	Veritas® Opti prior to canopy closure f/b Veritas Opti post-canopy closure	23 August 2023 Not Applied^
T4	Aviator® Xpro® prior to canopy closure f/b Carbendazim post-canopy closure	23 August 2023 Not Applied^
T5	Miravis® Star prior to canopy closure f/b Carbendazim post-canopy closure	23 August 2023 Not Applied^

Key: ^fungicide not applied due to seasonal conditions, f/b = followed by

Table 5. Fungicide product details including rate, active ingredient, and concentration, applied at Hart 2023.

Product	Active Ingredient (concentration)	Rate (mL or g/ha)
Aviator® Xpro®	Prothioconazole (150 g/L) + Bixafen (75 g/L)	600
Carbendazim	Carbendazim (500 g/L)	500
Miravis® Star	Fludioxonil (150 g/L) + Pydiflumetofen (100 g/L)	750
Veritas® Opti	Tebuconazole (370 g/L) + Azoxystrobin (222 g/L)	540
Procymidone	Procymidone (500 g/L)	500

Table 6. Trial site details, Hart 2023.

Trial design	Randomised Complete Block Design (RCBD)
Replicates	3
Data Analysis	Statistically analysed using ANOVA and Fisher's least significance difference (LSD) test in Genstat 23rd Edition
Sowing date	6 June 2023
Plant density	120 plants/m^2
Row spacing	23 cm
Fertiliser	80 kg/ha MAP + Zn
Harvest date	2 November 2023

Key messages:

- Botrytis grey mould and ascochyta blight in lentil were infrequently reported in SA in 2023.

Results and Discussion:

Botrytis grey mould and ascochyta blight in lentil were infrequently reported in SA in 2023. No disease infection occurred in lentil at Hart in 2023 due to low inoculum levels and dry spring conditions. For this reason, there was no yield response to fungicides applied to control disease (P=0.705). There was a grain yield response to variety (P<0.001, LSD=0.074), with PBA Jumbo2 (2.24 t/ha) yielding more than PBA Bolt and PBA Highland XT (2.12 t/ha and 2.06 t/ha, respectively).

Figure 3. Lentil disease management trial at Hart, August 2023.

LENTIL VARIETY X SEED SIZE TRIAL

Authors: *Sarah Day*

Aim: This trial aims to assess the effect of seed size on establishment, yield and yield components.

Treatments:

Varieties: GIA Leader, PBA Hallmark XT, PBA Jumbo2, PBA Kelpie XT

Seed size: Separated into three categories (small seed size, unseparated (Control), and large seed size) depending on seed weight (Table 7).

Table 7. Seed size categories of lentil varieties separated into small and large seed lots and the grain weights (g per 1000 seeds), Condowie 2023.

Variety	Small Seed Size (SSS)	Large Seed Size (LSS)	Small Seed Size (SSS) Grain weight (g/1000 seeds)	Unseparated (Control) Grain weight (g/1000 seeds)	Large Seed Size (LSS) Grain weight (g/1000 seeds)
GIA Leader	< 4.5 mm	> 4.5 mm	31.1	40.6	42.5
PBA Hallmark XT	< 4.5 mm	> 4.5 mm	32.4	39.0	42.8
PBA Jumbo2	< 5.0 mm	> 5.0 mm	40.7	45.7	53.5
PBA Kelpie XT	< 5.0 mm	> 5.0 mm	41.4	45.8	51.7

Table 8. Trial site details, Condowie 2023.

Trial design	Randomised Complete Block Design (RCBD)
Replicates	3
Data Analysis	Statistically analysed using ANOVA and Fisher's least significance difference (LSD) test in Genstat 23rd Edition
Sowing date	18 May 2023
Plant density	120 plants/m^2
Row spacing	23 cm
Fertiliser	80 kg/ha MAP + Zn
Harvest date	27 October 2023

Key messages:

- Lentil grain yield was not influenced by seed size, but variety selection was important.

Results and Discussion:

Normalised difference vegetation index (NDVI) was measured as a method of interpretating crop early vigour and/or ground cover. Lentil sown as small seed size plots (SSS) had reduced NDVI compared to the unseparated (control) plots and the large seed size (LSS) plots at both points measured for NDVI (Figure 4).

Despite early signs of reduced ground cover or early vigour, there was no lentil grain yield response to seed size sown, or the interaction between seed size and variety (Table 9). However, variety selection was important in maximising grain yield potential (Table 9). PBA Jumbo2 (2.07 t/ha) and PBA Hallmark XT (2.02 t/ha) were higher yielding than PBA Kelpie XT (1.86 t/ha) and GIA Leader (1.77 t/ha).

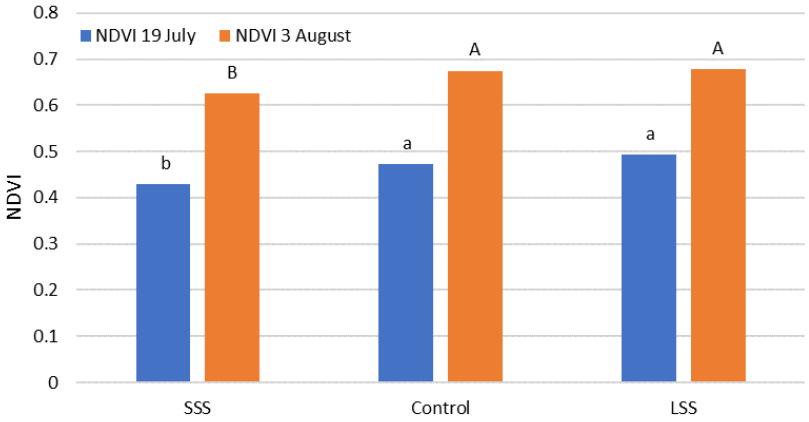

Figure 4. NDVI response to seed size category measured on two occasions (19 July and 3 August), suggesting separating lentil seed into large seed size lots is not advantageous for early vigour and ground cover compared to the control, at Condowie 2023. Bars labelled with the same letter and case (upper and lower case) are not significantly different (P<0.05).

Table 9. Grain yield (t/ha) response to seed size category and variety of lentil sown at Condowie, 2023. There was a significant grain yield response to lentil variety alone (P<0.05), but not to seed size category, or the interaction between variety and seed size (P>0.05). ns = not significant (P>0.05)

	Grain yield (t/ha)				
Variety	**SSS**	**Control**	**LSS**	***Avg***	
GIA Leader	1.90	1.71	1.71	*1.77*	*b*
PBA Hallmark XT	1.87	2.14	2.03	*2.02*	*a*
PBA Jumbo2	2.03	2.03	2.15	*2.07*	*a*
PBA Kelpie XT	1.88	1.81	1.88	*1.86*	*b*
Avg	*1.92*	*1.92*	*1.94*	*1.93*	
LSD (P<0.05)					
Variety x Seed size		ns			
Variety		0.136			
Seed size		ns			

CHICKPEA VARIETY X SEED SIZE TRIAL

Authors: *Sarah Day*

Aim: This trial aims to assess the effect of seed size on establishment, yield and yield components.

Treatments:
Varieties: PBA Magnus, PBA Monarch, PBA Royal, Genesis^{TM}090
Seed size: Separated into three categories (small seed size, unseparated (Control), and large seed size) depending on seed weight (Table 10).

Table 10. Seed size categories of chickpea varieties separated into small and large seed lots and the grain weights (g per 1000 seeds), Condowie 2023.

Variety	Small Seed Size (SSS)	Large Seed Size (LSS)	Small Seed Size (SSS) Grain weight (g/1000 seeds)	Unseparated (Control) Grain weight (g/1000 seeds)	Large Seed Size (LSS) Grain weight (g/1000 seeds)
Genesis090	< 8 mm	> 8 mm	260.5	269.4	333.2
PBA Magnus	< 10 mm	> 10 mm	365.4	396.5	491.2
PBA Monarch	< 8 mm	> 8 mm	247.6	286.9	359.0
PBA Royal	< 8 mm	> 8 mm	260.0	302.2	360.0

Table 11. Trial site details, Condowie 2023.

Trial design	Randomised Complete Block Design (RCBD)
Replicates	3
Data Analysis	Statistically analysed using ANOVA and Fisher's least significance difference (LSD) test in Genstat 23rd Edition
Sowing date	18 May 2023
Plant density	35 plants/m^2
Row spacing	23 cm
Fertiliser	80 kg/ha MAP + Zn
Harvest date	10 November 2023

Key messages

- Seed size and variety were important factors for early crop vigour and ground cover.
- Chickpea grain yield was not influenced by seed size or variety.

Results and Discussions:

Normalised difference vegetation index (NDVI) was measured as a method of interpretating crop early vigour and/or ground cover. There was an NDVI response to variety and seed size, individually (Table 12). However, there was no NDVI response to the interaction between the two factors: variety and seed size. Of the varieties, PBA Monarch had reduced ground cover and/or early vigour compared to other varieties. In July, chickpea sown in the small seed size (SSS) lots had reduced ground cover or vigour than unseparated (control), however, SSS growth had caught up to unseparated (control) and large seed size plots by early August.

Despite early ground cover or vigour differences in response to variety and seed size, separately, there was no grain yield response to any factor or the interaction between factors. Average chickpea grain yield was 1.24 t/ha for the site at Condowie, 2023.

Table 12. NDVI response to seed size category and variety, and the interaction of seed size and variety, measured on two occasions (19 July and 3 August) at Condowie, 2023. There was a significant NDVI response to chickpea variety (P<0.05) and chickpea seed size (P<0.05), but not to the interaction between variety and seed size (P>0.05). ns = not significant (P>0.05).

	19 July					3 August				
Variety	**SSS**	**Control**	**LSS**	***Avg***		**SSS**	**Control**	**LSS**	***Avg***	
Genesis090	0.343	0.340	0.353	0.346	a	0.497	0.487	0.540	*0.508*	*ab*
PBA Magnus	0.337	0.347	0.387	0.357	a	0.507	0.560	0.550	*0.539*	*a*
PBA Monarch	0.250	0.323	0.327	0.300	b	0.353	0.447	0.470	*0.423*	*c*
PBA Royal	0.303	0.357	0.347	0.336	a	0.463	0.503	0.503	*0.490*	*b*
Avg	0.308 b	0.342 a	0.353 a	*0.0334*		0.455 b	0.499 ab	0.516 b	*0.0490*	
LSD (P<0.05)										
Variety x Seed size			ns					ns		
Variety			0.034					0.041		
Seed size			0.030					0.046		

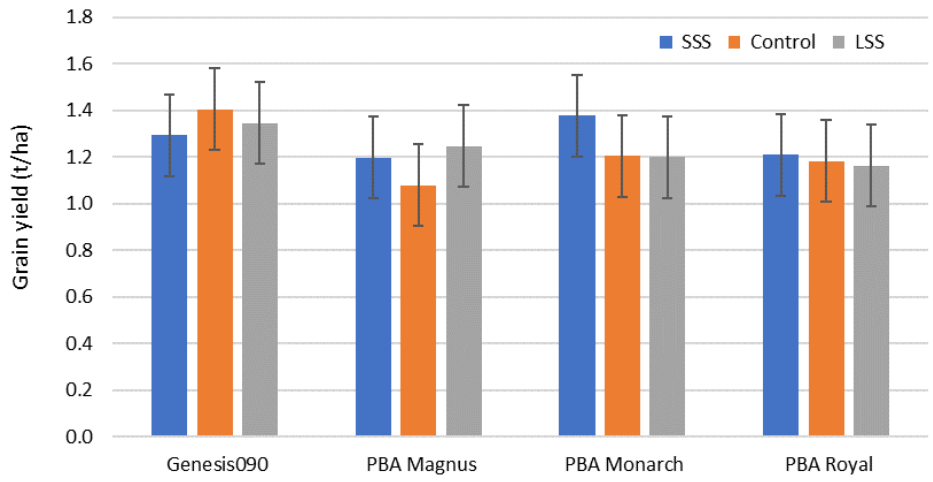

Figure 5. Grain yield (t/ha) response to the interaction between chickpea variety and seed size category, at Condowie 2023. Error bars represent the least significant difference (LSD) for the interaction between variety and seed size, showing no significant differences (P>0.05).

RIVERTON/TARLEE – SPOKE SITE

SITE SUMMARY

The Riverton/Tarlee spoke site was split into two locations in 2023. Lentil was the focus of the Riverton field trial site, while faba beans were sown at the Tarlee field trial site. The Riverton field trial site was situated on moderate to strong alkaline brown clay soil (Table 13). The Tarlee field trial site was situated on moderate to strong alkaline brown to grey loamy clay soil with a relatively high gravel content (Table 14). The topsoil layers contained optimal levels of nitrogen, but these levels reduced with depth. Both soils had low organic carbon (OC) and moderate salinity.

Riverton received monthly rainfall totals of average or above average for the start of the growing season (April-June), providing adequate moisture for crop establishment and vegetative growth (Figure 6). However, well below average rainfall for July to October limited soil moisture availability to the crop during reproductive growth stages. Despite the lack of rainfall during late winter and into spring, there were no frost events (<0°C) during this time. The only frost event that occurred at the trial site was recorded in May, reaching -1°C overnight.

The average grain yield for faba bean was 4.24 t/ha at Tarlee. The average grain yield for lentil was 3.50 t/ha and field pea was 3.58 t/ha at Riverton.

Table 13. Riverton soil profile characterisation (brown clay), 2023.

Depth	NH_3-N	NO_3-N	P	K	S	OC	EC	pH	pH	PBI
(cm)			(mg/kg)			(%)	(dS/m)	($CaCl_2$)	(H_20)	
0-10	1	23	21	763	6.7	1.50	0.270	7.4	8.0	93.2
10-30	1	4	<2	459	10.1	0.41	0.388	7.7	8.7	
30-60	<1	2	<2	267	60.4	0.23	0.582	7.8	9.3	
60-90	<1	<1	2	229	72.9	0.19	0.621	8.0	9.8	
90-120	<1	1	<2	289	72.6	0.12	0.664	8.1	9.8	

Depth	Cu	Fe	Mn	Zn	B	Exc Ca	Exc Mg	Exc K	Exc Na	Exc Al
(cm)			(mg/kg)					(meq/100g)		
0-10	1.31	14.0	10.48	1.21	2.01	20.32	4.44	1.82	0.72	0.017
10-30	1.98	10.2	2.69	0.44	5.78	21.29	9.83	1.33	4.48	0.021
30-60	1.43	7.0	1.03	0.31	8.93	12.35	7.95	0.74	4.79	0.018
60-90	0.77	5.1	0.68	0.22	7.72	8.88	6.64	0.54	5.23	0.021
90-120	0.50	5.6	0.64	0.19	9.75	8.08	7.80	0.68	6.99	0.023

Table 14. Tarlee soil profile characterisation (brown to grey loam/clay), 2023.

Depth	NH_3-N	NO_3-N	P	K	S	OC	EC	pH	pH	PBI
(cm)			(mg/kg)			(%)	(dS/m)	($CaCl_2$)	(H_20)	
0-10	1	37	27	810	25.7	1.94	0.279	7.4	7.9	76.8
10-30	1	13	9	337	50.3	0.87	0.302	7.6	8.7	
30-60	<1	3	3	336	60.2	0.22	0.295	7.9	9.6	
60-90	1	3	2	409	31.8	0.16	0.233	8.2	10.1	
90-120	2	7	2	405	34.3	0.22	0.350	7.7	9.6	

Depth	Cu	Fe	Mn	Zn	B	Exc Ca	Exc Mg	Exc K	Exc Na	Exc Al
(cm)			(mg/kg)					(meq/100g)		
0-10	0.52	9.30	9.77	1.52	2.32	20.96	1.93	1.63	0.33	0.011
10-30	0.53	6.80	2.76	0.72	3.09	16.71	1.93	0.52	0.94	0.031
30-60	0.17	2.10	0.46	1.56	1.59	10.03	2.22	0.27	1.46	0.014
60-90	0.15	5.80	0.80	0.11	0.71	7.08	2.81	0.31	1.62	0.016
90-120	0.18	5.20	0.91	0.19	1.15	7.93	5.06	0.54	2.45	0.018

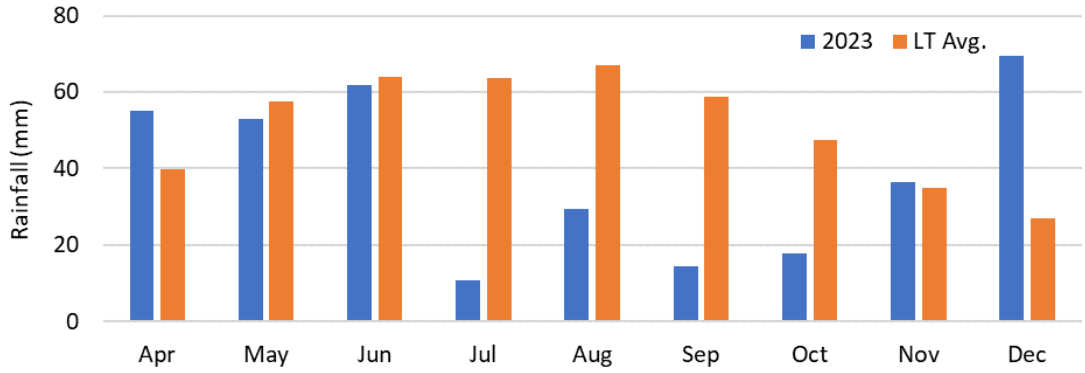

Figure 6. Monthly rainfall recorded at the Riverton field trial site in 2023 compared to the long-term average rainfall from the Riverton BOM weather station (#23314).

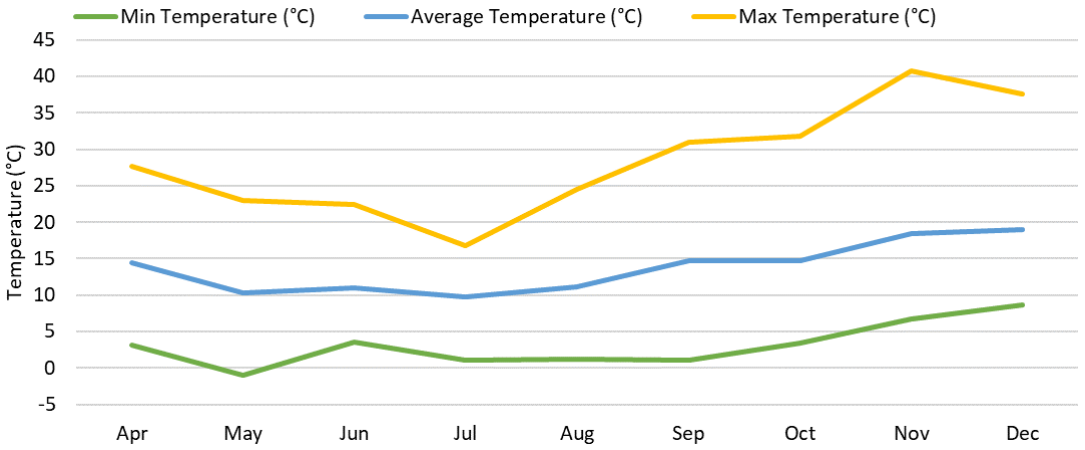

Figure 7. Minimum, average and maximum temperature recorded at the Riverton field trial site in 2023.

LENTIL DISEASE MANAGEMENT

Authors: *Sarah Day, Sara Blake*

Aim: This trial aims to assess (1) yield loss from disease infection and (2) economics of disease management control strategies

Treatments:

Varieties: See Table 15.

Fungicide treatments: See Table 16.

All seed was treated with EverShield Seed Treatment to protect seedlings from early disease infection.

Each treatment consisted of 3 key fungicide application stages; prior to canopy closure, post-canopy closure but prior to podding applied ahead of rain, and at early podding.

All fungicides were applied ahead of a rain event where > 5 mm was forecast.

Table 15. Disease ratings of lentil varieties included in disease management trial at Riverton, 2023.

Variety	Botrytis Grey Mould	Ascochyta Blight (Foliar)	
		Pathotype 1 (Nipper virulent)	Pathotype 2 (PBA Hurricane XT virulent)

PBA Bolt	S	MR	MRMS
PBA Highland XT	MS	MR	MR
PBA Jumbo2	MR (P)	R	RMR (P)

Key: S = susceptible, MS = moderately susceptible, MRMS = moderately resistant/moderately susceptible, MR = moderately resistant, R = resistant, (P) = provisional rating and subject to change when additional data becomes available.

Table 16. Six fungicide treatments applied to control disease in lentil at Riverton, 2023.

Treatment	Details	Date applied
T1	Untreated control	
T2	Procymidone prior to canopy closure f/b Chlorothalonil at early podding	15 August 2023 29 September 2023
T3	Veritas® Opti prior to canopy closure f/b Veritas Opti at early podding	15 August 2023 29 September 2023
T4	Aviator® Xpro® prior to canopy closure f/b Chlorothalonil at early podding	15 August 2023 29 September 2023
T5	Miravis® Star prior to canopy closure f/b Chlorothalonil at early podding	15 August 2023 29 September 2023

Key: f/b = followed by

Table 17. Fungicide product details including rate, active ingredient, and concentration, as used at Riverton 2023.

Product	**Active Ingredient (concentration)**	**Rate (mL or g/ha)**
Aviator® Xpro®	Prothioconazole (150 g/L) + Bixafen (75 g/L)	600
Carbendazim	Carbendazim (500 g/L)	500
Chlorothalonil	Chlorothalonil (720 g/L)	2000
Miravis® Star	Fludioxonil (150 g/L) + Pydiflumetofen (100 g/L)	750
Veritas® Opti	Tebuconazole (370 g/L) + Azoxystrobin (222 g/L)	540
Procymidone	Proymidone (500 g/L)	500

Table 18. Trial site details, Riverton 2023.

Trial design	Randomised Complete Block Design (RCBD)
Replicates	3
Data Analysis	Statistically analysed using ANOVA and Fisher's least significance difference (LSD) test in Genstat 23rd Edition
Sowing date	24 May 2023
Plant density	120 plants/m2
Row spacing	23 cm
Fertiliser	80 kg/ha MAP + Zn
Harvest date	13 November 2023

Results and Discussion:

Botrytis grey mould and ascochyta blight in lentil were infrequently reported in SA in 2023. No disease infection occurred in lentil at Riverton in 2023. July conditions were conductive to disease progression. However, canopy closure was not reached until late August, followed by a dry spring, slowing any disease progression. For this reason, there was no yield response to fungicides applied to control disease (P=0.195). There was a grain yield response to variety (P=0.011, LSD=0.2566), with PBA Jumbo2 (3.74 t/ha) yielding more than PBA Highland XT and PBA Bolt (3.41 t/ha and 3.37 t/ha, respectively).

Figure 8. Canopy closure in lentil was not achieved until late August, at Riverton 2023. Photo credit: Sarah Day, 7 August 2023.

Figure 9. Dry spring conditions halted disease progression, despite large crop canopies developing by spring, at Riverton 2023. Photo credit: Sarah Day, 29 September 2023.

FABA BEAN DISEASE MANAGEMENT

Authors: *Sarah Day, Sara Blake*

Aim: This trial aims to assess (1) yield loss from disease infection, and (2) economics of disease management control strategies

Treatments:

Varieties: PBA Bendoc, PBA Amberley, PBA Samira

Fungicide treatments: See Table 19.

All fungicides are applied ahead of a rain event where > 5 mm is forecast.

Table 19. Five fungicide treatments applied to faba bean at Tarlee, 2023.

Treatment	Details	Date applied
T1	Untreated control	
T2	Tebuconazole at 6 weeks post sowing f/b Procymidone prior to canopy closure f/b Carbendazim post-canopy closure	20 June 2023 18 July 2023 Not applied^
T3	Veritas® Opti prior to canopy closure f/b Veritas® Opti post-canopy closure	18 July 2023 Not applied^
T4	Aviator® Xpro®prior to canopy closure f/b Aviator® Xpro® post-canopy closure	18 July 2023 Not applied^
T5	Miravis® Star prior to canopy closure f/b Miravis® Star post-canopy closure	18 July 2023 Not applied^

Key: f/b = followed by, ^fungicide not applied due to seasonal conditions and height of crop and safety of application

Table 20. Fungicide product details including rate, active ingredient, and concentration, as used at Tarlee 2023.

Product	Active Ingredient (concentration)	Rate (mL or g/ha)
Aviator® Xpro®	Prothioconazole (150 g/L) + Bixafen (75 g/L)	600
Carbendazim	Carbendazim (500 g/L)	500
Miravis® Star	Fludioxonil (150 g/L) + Pydiflumetofen (100 g/L)	750
Tebuconazole	Tebuconazole (430 g/L)	350
Veritas® Opti	Tebuconazole (200 g/L) + Azoxystrobin (120 g/L)	540
Procymidone	Procymidone (500 g/L)	500

Table 21. Trial site details, Tarlee 2023.

Trial design	Randomised Complete Block Design (RCBD)
Replicates	3
Data Analysis	Statistically analysed using ANOVA and Fisher's least significance difference (LSD) test in Genstat 23rd Edition
Sowing date	4 May 2023

Plant density	24 plants/m^2
Row spacing	23 cm
Fertiliser	80 kg/ha MAP + Zn
Harvest date	9 November 2023

Results and Discussion:

Chocolate spot and ascochyta blight in faba bean were infrequently reported in SA in 2023. Very low levels of ascochyta blight were identified on moderately susceptible variety PBA Marne in early August (Figure 10). However, the dry spring conditions halted any disease progression at the site. For this season, there was no grain yield response to fungicides applied to control disease (P=0.963). There was also no grain yield response to variety selection (P=0.217), with PBA Samira, PBA Marne and PBA Amberley yielding 4.14-4.33 t/ha.

Figure 10. Low levels of ascochyta blight identified on moderately susceptible variety PBA Marne at Tarlee, 2023. Photo credit: Sarah Day, 7 August 2023.

Figure 11. Dry spring conditions halted disease progression, despite large crop canopies developing at Tarlee, 2023. Photo credit: Sarah Day, 15 August 2023.

MELROSE – SPOKE SITE

SITE SUMMARY

The Melrose field trial site was situated on a soil profile where the topsoil is a light brown acidic loam, shifting to a brown alkaline clay at depth, with a relatively high gravel content throughout (Table 22).

The Melrose field trial site experienced numerous frost events during the 2023 growing season, with a total of 37 events where overnight temperatures fell below zero degrees Celsius (Figure 12). Six frost events occurred in May, with the lowest temperature reaching -2.9°C. No frost events occurred in June, coinciding with the average rainfall for the region. As rainfall events reduced throughout winter and spring, frost event occurrence increased. 11 frost events were recorded in July, at times occurring for three consecutive nights, with the lowest temperature reaching -2.1°C. A total of ten frost events occurred in August, with seven of these events occurring consecutively in early August. Of these consecutive frost events, three nights fell below -4.4°C, with the lowest recorded at -4.7°C. September saw a further eight frost events, with four occurring consecutively in early September, with the lowest recorded at -3.8°C. Two frost events occurred in October. Late September and October frost events occurred as daytime temperatures were increasing, causing both cold and heat stress to crops during reproductive growth stages.

Rainfall was well below the long-term average for most of the growing season near Melrose in 2023 (Figure 13). The drier than usual conditions, combined with the cold temperatures that coincided with the dry, were not ideal conditions for vegetative crop growth or for reproductive development.

The site average grain yield was 0.62 t/ha for lentil and 0.98 t/ha for field pea.

Table 22. Melrose soil profile characterisations (brown-red clay), 2023.

Depth (cm)	NH_3-N	NO_3-N	P (mg/kg)	K	S	OC (%)	EC (dS/m)	pH ($CaCl_2$)	pH (H_20)
0-10	3	9	58	421	14.5	0.98	0.114	5.9	6.4
10-30	2	4	6	524	24.8	0.62	0.217	6.9	8.1
30-60	1	2	5	469	58.4	0.45	0.504	7.1	8.5
60-90	<1	1	3	477	168.6	0.24	0.981	8.0	8.9
90-120	<1	<1	6	441	235.6	0.19	1.220	7.8	8.7

Depth (cm)	Cu	Fe	Mn (mg/kg)	Zn	B	Exc Ca	Exc Mg	Exc K (meq/100g)	Exc Na	Exc Al
0-10	1.63	33.7	55.94	6.37	0.92	5.99	2.62	0.85	0.59	0.016
10-30	1.68	13.6	4.68	0.33	3.30	12.10	10.25	1.31	3.74	0.039
30-60	1.58	14.1	3.08	1.69	6.06	11.82	11.73	1.33	5.68	0.030
60-90	1.28	14.2	4.42	0.17	7.81	11.22	11.06	1.27	7.28	0.023
90-120	1.17	13.3	3.84	0.66	11.85	11.88	10.80	1.25	7.71	0.019

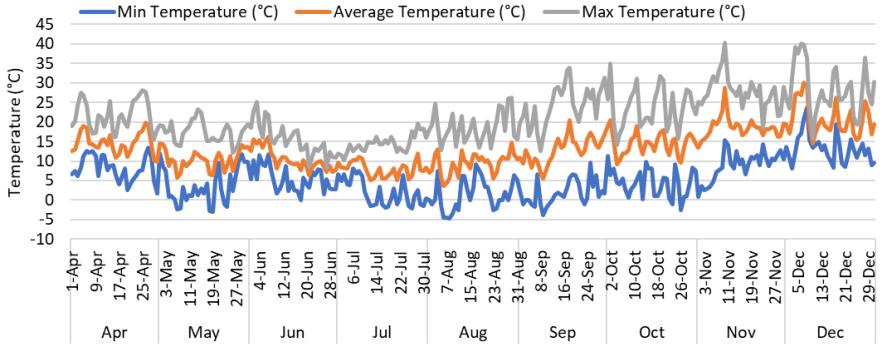

Figure 12. Minimum, average, and maximum temperature recorded at the Melrose field trial site, 2023.

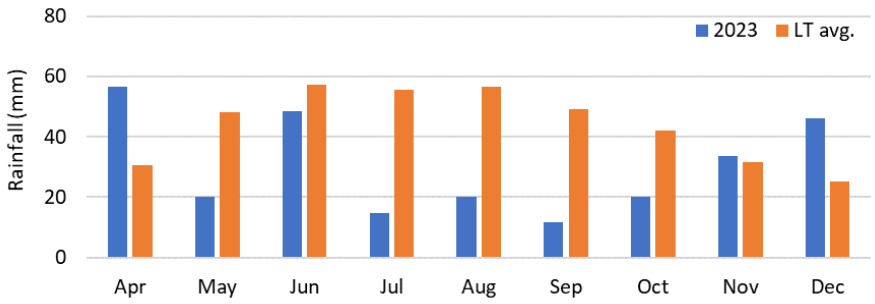

Figure 13. Monthly rainfall recorded at the Melrose field trial site in 2023 compared to the long-term average rainfall from the Melrose (Para Gums) BOM weather station (19042).

FIELD PEA VARIETY X DENSITY TRIAL

Authors: *Sarah Day*

Aim: This trial aims to assess (1) field pea variety production performance in the low rainfall zone, and (2) field pea production when sown at different seeding densities.

Treatments:

Varieties: PBA Butler, GIA Ourstar, GIA Kastar, PBA Wharton, PBA Taylor, PBA Percy.

Densities: 35, 55 and 75 plants/m^2 (Table 23).

Table 23. Seeding rate treatments with associated target plants/m^2 and kg/ha rates.

Seeding rate	Plants/m^2	kg/ha*
High	75	145-175
Recommended	55	105-130
Low	35	65-85

*A range is given for seeding rate per hectare as this will vary depending on actual seed size and seed weight.

Table 24. Trial site details, Melrose 2023.

Trial design	Randomised Complete Block Design (RCBD)
Replicates	3
Data Analysis	Statistically analysed using ANOVA and Fisher's least significance difference (LSD) test in Genstat 23rd Edition
Sowing date	31 May 2023
Plant density	as per treatments
Row spacing	23 cm
Fertiliser	80 kg/ha MAP + Zn
Harvest date	3 November 2023

Key messages

- Field pea variety selection will influence grain yield and harvestability, depending on phenology, herbicide tolerance and lodging resistance traits of individual varieties.

Results and Discussion:

Crop lodging at maturity is common in field pea and was influenced by variety (P<0.001, Figure 14), but not seeding rate (P=0.079, data not shown), at Melrose in 2023.

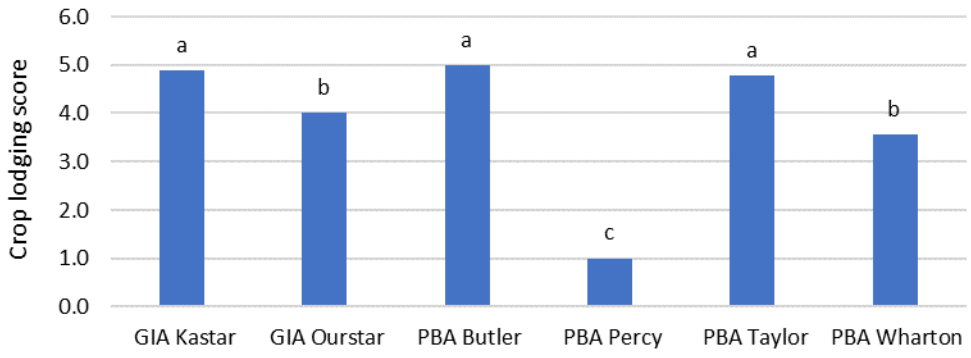

Figure 14. Crop lodging at maturity was influenced by field pea variety, at Melrose 2023. Columns labelled with different letters indicates a significant difference (P<0.001). Crop lodging is scored on a 1-9 system, where 1 = flat (0°) and 9 = erect (90°).

Grain yield was influenced by the interaction between field pea variety and seeding rate (Figure 15), although there was no trend in response to seeding rate alone (P=0.581). PBA Percy, PBA Taylor and PBA Wharton yielded over 1 t/ha and were higher yielding than PBA Butler, GIA Kastar and GIA Ourstar, all of which yielded below 1 t/ha. Grain yield was reduced in 2023 due to spring frost events aborting flowers and terminating developing grains (Figure 12).

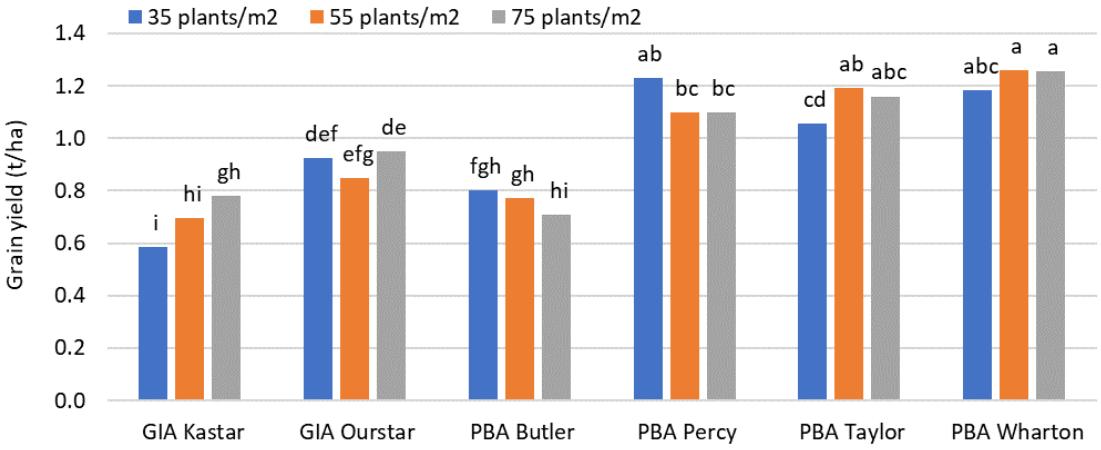

Figure 15. Grain yield of field pea varieties sown at three different sowing rates, at Melrose 2023. Columns labelled with different letters indicates a significant difference (P=0.034, LSD = 0.1355).

LENTIL VARIETY TRIAL, MELROSE

Authors: *Sarah Day*

Aim: This trial aims to assess grain yield production of different lentil varieties.

Treatments:
Varieties (9): PBA Hurricane XT, PBA Highland XT, PBA Hallmark XT, PBA Kelpie XT, GIA Lightning, GIA Thunder, GIA Sire, GIA Metro, GIA Leader.

Table 25. Trial site details, Melrose 2023.

Trial design	Randomised Complete Block Design (RCBD)
Replicates	3
Data Analysis	Statistically analysed using ANOVA and Fisher's least significance difference (LSD) test in Genstat 23rd Edition
Sowing date	31 May 2023
Plant density	120 plants/m^2
Row spacing	23 cm
Fertiliser	80 kg/ha MAP + Zn
Harvest date	3 November 2023

Key messages

- Developments in lentil variety agronomic characteristics and herbicide tolerance traits will assist expansion of lentil production into low rainfall zones.

Results and Discussion:

Grain yield production was influenced by variety selection at Melrose in 2023 (Figure 16). PBA Hallmark XT, PBA Hurricane XT, GIA Leader and GIA Thunder were higher yielding than PBA Kelpie, GIA Sire and GIA Metro. Although lower yielding, GIA Sire and GIA Metro are new dual herbicide-tolerant lentil varieties that have a unique fit in the farming system where herbicide residues or resistant weed populations are present.

Grain yield was low due to the high frequency and duration of frost events (Figure 12) occurring during vegetative and reproductive growth stages. There does not appear to be a clear trend in grain yield as a reflection of variety phenology.

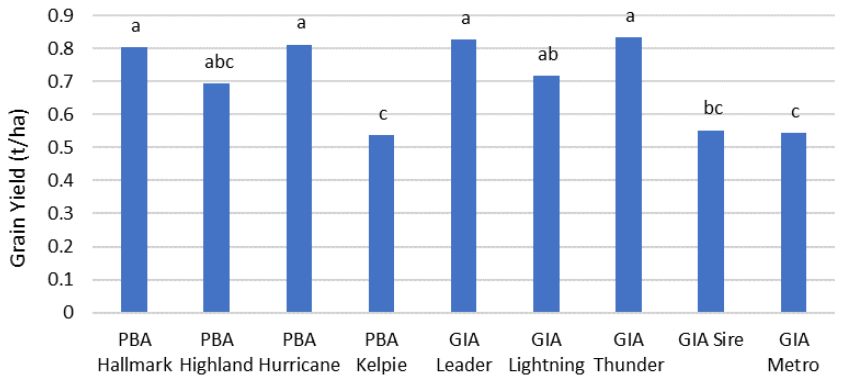

Figure 16. Grain yield (t/ha) differed between lentil varieties, at Melrose 2023.